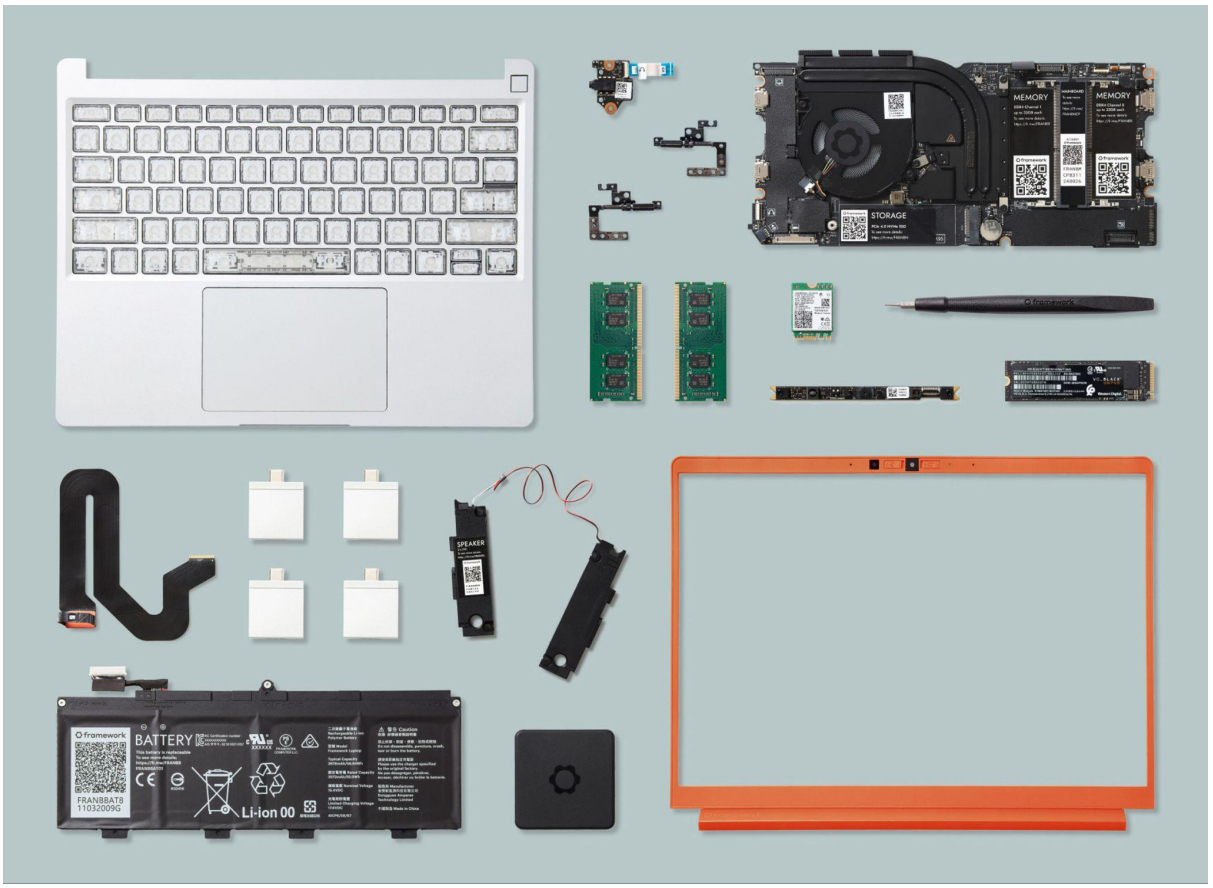
Research report of R. Cavdar



Amsterdam University of Applied Sciences

The future is modular; how Framework Computer, Inc. challenges tech ethics

An ethical analysis of Framework and their goal of repairability, upgradability, sustainability, and their fight against e-waste and planned obsolescence.

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Summary

Exemple

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1. Introduction

I'm Remzi Cavdar, a 30-year-old student at the Amsterdam University of Applied Sciences (AUAS), pursuing a degree in HBO-ICT Software Engineering. Beyond my academic pursuits, I have a passion for technology. Over the years, I've built computers for myself and others, and have often been the go-to person for PC-related issues among friends and family.

A decade ago, I was deeply entrenched in the throwaway culture, frequently purchasing and discarding items without much thought. However, as I matured, I became more conscious of my consumption habits, especially regarding electronics. I began to prioritise quality and longevity in my purchases, ensuring that I got the best value for my money and reduced my environmental footprint.

From throwaway culture to Framework's revolution

In today's fast-paced tech world, consumers are constantly enticed by the latest gadgets. This relentless pursuit of the ‘new’ has a hidden cost: a surge in e-waste and a culture of planned obsolescence. Many devices are discarded while still functional or with minor issues, primarily because the industry encourages replacement over repair. This not only has severe environmental implications but also raises ethical concerns.

Nirav Patel, having observed this wasteful trend, recognized the inherent problems. He noticed that many laptops were discarded due to the high cost of repairing or replacing a single part. Such practices, he realised, were not only environmentally harmful but also unsustainable in the long run. With a background in Electrical and Computer Engineering from Carnegie Mellon University and experience at tech giants like Apple, Oculus, and Meta, Patel envisioned a different kind of laptop—one that prioritised repairability, upgradability, and customisability.

In January 2020, he founded Framework Computer, Inc. to bring this vision to life. He rallied investors who believed in his mission and assembled a team of hardware and software engineers. Together, they worked tirelessly to produce the first Framework laptop, and in the subsequent years, the team and their vision only expanded.

Framework's commitment goes beyond just selling products. They're advocates for the 'right to repair' movement, aiming to reshape consumer behaviour and industry standards. Their laptops, while premium-priced, offer unparalleled value in terms of repairability, upgradability, and support for open-source software.

A hallmark of Framework's design philosophy is the standardised case dimensions they've adopted. This ensures that when designing a new motherboard (also called mainboard), it will fit seamlessly into the existing laptop chassis. This design foresight allows for significant upgradability, ensuring the laptop remains relevant and powerful even as technology advances.

Another standout feature is the 'Port Expansion Cards.' These plug-and-play modules, whose designs are open-sourced, allow users to customise their laptop ports. This open-source approach has spurred a community of enthusiasts to create their own custom port cards, further enhancing the laptop's adaptability and user-centric design.

Summary

Framework, founded by Nirav Patel in 2020, is pioneering a shift in the tech industry towards repairability, upgradability, and sustainability. Their products, while offering financial savings in the long run, also promote environmental conservation. By championing repair over replacement, Framework is not only challenging planned obsolescence but also setting a benchmark for future tech innovations.

2. The facts

In the Netherlands, we have around 8,3 million households (Centraal Bureau voor de Statistiek, n.d.). There are almost no academic research papers on how much consumers spend on electronics and gadgets each year, however US PIRG, a research group, did research about e-waste in American households and we can extrapolate this information and presume that this is the case for all Western households. In The Netherlands each household consists on average of 2,12 people, this also includes people who are living alone (Centraal Bureau voor de Statistiek, n.d.).

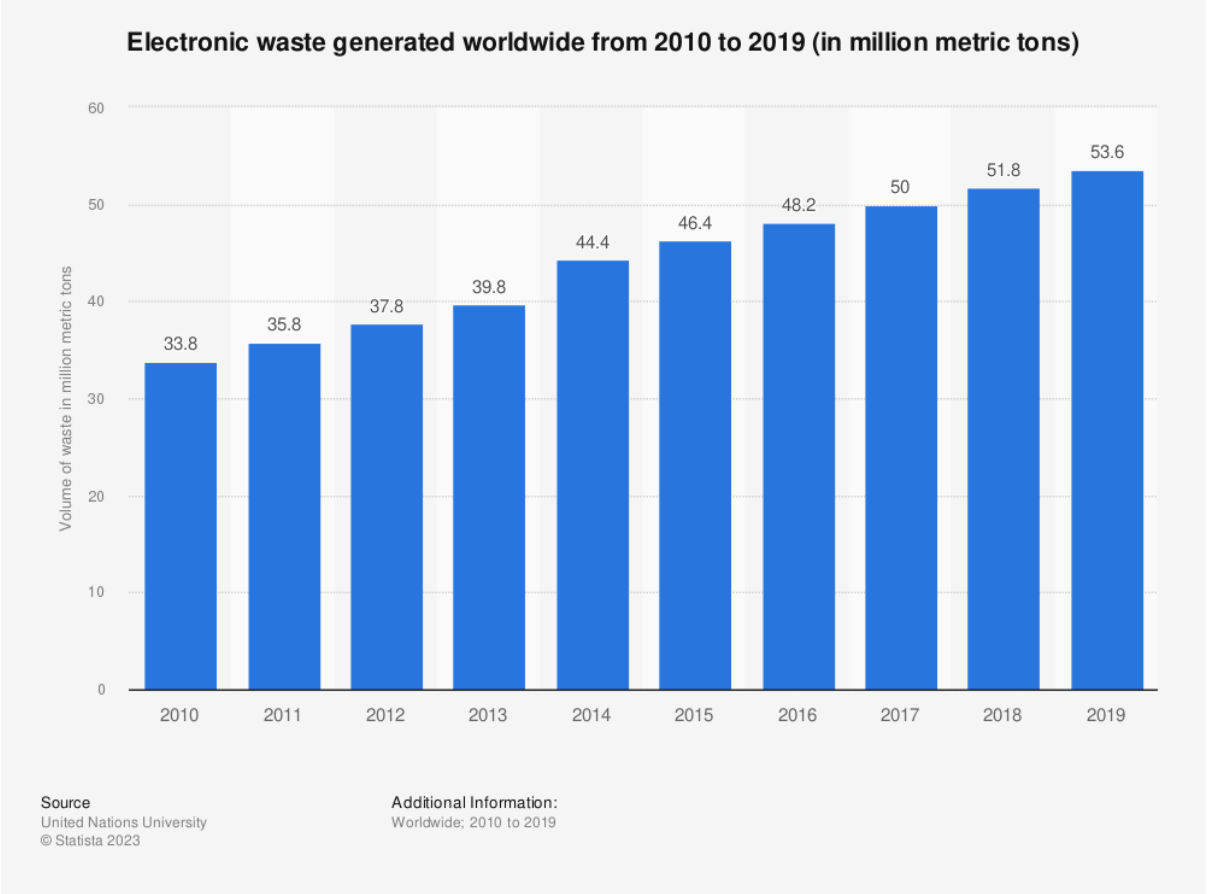
Each household spends, on average, 1,400 euros on electronics every year. People often buy gadgets that don't last very long because everyone wants the latest phone or device. As a result, the old devices often get thrown away or forgotten in a drawer. Only a few people recycle their old devices, like giving an old phone to a family member, friend, or second-hand shop. Continuously discarding old devices and buying new ones wastes a lot of resources, which is terrible for the environment (United States Public Interest Research Group, Inc., 2021).

Globally, electronic waste (e-waste) production exceeds 50 million metric tons annually, which equates to an average of about seven kilograms for every individual. A staggering 70% of the total toxic waste we produce is attributed to e-waste, and a mere 12.5% of this waste is actually recycled (The World Counts, n.d.).

In the EU, electronic waste (e-waste) is rapidly increasing, with under 40% being recycled. Data from 2020 indicates that for every EU resident, approximately 10.3 kilograms of electronic and electrical equipment waste was amassed (EU Monitor, 2023).

According to the German bureau of statistics, around 4.7 million tons of waste from electrical and electronic equipment was disposed of in 2020. This translates to an average of 10.5 kilograms for each individual in Germany (Destatis, 2023).

Based on the information above, we can estimate that a typical person in the Western world spends about 660 euros on electronics (including gadgets and household appliances) every year and produces between 10 and 11 kilograms of electronic waste per year.



Based on the infographic above, we can see that the e-waste is growing each year, which is very alarming.

To address the growing concern of e-waste, the European Commission unveiled a circular economy action plan in March 2020. This plan prioritises minimising electronic and electrical waste. Key initiatives from this plan include establishing a right to repair, enhancing product reusability, introducing a standardised charger, and incentivizing electronic recycling. By the close of 2024, the EU has mandated the USB Type-C as the universal charger for most electronic gadgets. Furthermore, by 28 April 2026, laptops must be fitted with a USB Type-C

port. In a subsequent move in March 2023, the Commission proposed measures to bolster the repair and reuse of items. This proposal mandates sellers to fix products during their warranty period unless replacement is more cost-effective. Beyond the warranty, the proposal seeks to simplify and reduce the cost of repairs (European Parliament, 2020).

In evaluating the broader implications of companies like Framework, understanding the current awareness levels about e-waste becomes pivotal. A study conducted among engineering students in India revealed several insights. Students had a basic familiarity with e-waste generation, but their depth of understanding was limited, underscoring the need for enhanced awareness initiatives. Interestingly, students from metropolitan areas demonstrated a more robust grasp of e-waste management practices compared to their counterparts from smaller cities. Yet, both groups recognized the significance of extended producer responsibility as a viable solution. While they were aware of the hazardous materials present in e-waste, their knowledge about the variety of these materials and their environmental and health impacts was not comprehensive. However, they did acknowledge the presence of valuable metals within e-waste. The study also highlighted the students' perception of e-waste management as a promising business avenue and their keen interest in integrating e-waste topics into their academic curriculum. These findings underscore the vital role that companies like Framework can play in enhancing awareness and championing sustainable tech practices (Mor, R. S., Sangwan, K. S., Singh, S., Singh, A., & Kharub, M., 2021).

The ‘right to repair’ movement, which champions the autonomy of individuals to repair and modify their own devices, is rapidly gaining traction. As word of mouth spreads and awareness grows, an increasing number of people are rallying behind the cause, voicing their frustrations and demands for products they can personally repair. This surge in support is not just a fleeting trend; it's a reflection of a broader societal shift. Many are growing weary of big tech corporations that appear to prioritise profits over product longevity, often at the expense of consumers. The blatant practices of planned obsolescence, where devices are designed to have a limited lifespan, have left many feeling exploited. As a result, there's a burgeoning desire for change, with consumers yearning for quality, durability, and the freedom to repair their own devices without corporate constraints. This movement is not just about repairing—it's a call for transparency, fairness, and a pushback against corporate greed (Ozturkcan, S., 2023).

3. Technologies

Almost all Framework laptops uses proprietary UEFI firmware, InsydeH2O by Insyde Software, except for their 12th Gen Intel Core Chromebook Edition which uses coreboot (which is an open source project) as UEFI and all laptops use an open sourced embedded controller firmware based on CrOS EC (Chromium OS Embedded Controller). Framework

Computer, Inc. has open sourced their EC firmware and announced this on 21 January 2022. In addition Framework is currently testing their Linux Vendor Firmware Service (LVFS) with a tool called fwupd. For those keen on tech details, this helps in updating the firmware under Linux (LVFS, 2022).

The hardware is composed of essential components like the mainboard (which is the motherboard), a processor, RAM, and storage. Additionally, customization options allow you to select the bezel colour, keyboard layout and language, power adapter, and expansion cards for various ports.

Not everything is open source

Framework has addressed the issue that their UEFI is not open source, Mr. Patel (2021), the founder and CEO of Framework, has collaborated on why this is the case *"Yep, open source firmware is well aligned to our mission of building products that are better for people and the planet. Our EC firmware is based on chromium-ec, and we will be releasing source. As @Kieran_Levin noted, we're also exploring coreboot. We're currently focused on getting the Framework Laptop out into the world in a lower-risk path that uses an off the shelf proprietary BIOS, but we're looking forward to replacing that with an open alternative in the future."*

In the above quote Mr. Patel is also referring to Kieran Levin, the "Lead System Architect" of Framework in that discussion.

This essentially means that shipping a workable laptop with ready made UEFI has priority, so Framework can get financial stability and grow market share, and in the meantime Framework is able to research and develop a coreboot solution at a later time. The project maintainers have told the Framework community it's the hardware manufacturer's responsibility to make this work and that they can only advise and help them. The coreboot project even maintains a list of contractors who specialise in coreboot development (Coreboot, n.d.).

Potential pitfalls

Potential pitfalls of open source revolve around its very nature of being freely accessible and modifiable. While it promotes innovation and collaboration, the decentralised nature can sometimes lead to inconsistent quality or security vulnerabilities. Without a dedicated team or clear governance, some open-source projects may lag in updates or become abandoned, leaving users without support. Additionally, the lack of a straightforward revenue model can pose sustainability challenges for projects relying solely on open-source contributions. Despite its many advantages, navigating the open-source landscape requires caution and due diligence.

4. Stakeholders

There are two different stakeholders in every project and/or activity. Parties who are directly involved and have a direct relationship and interest in the project and/or activity. And there are parties who are indirectly involved. This report will analyse both.

Parties directly involved

Framework Computer, Inc. abbreviated as Framework, who is directly involved as a company. They are directly involved, because they are the seller and hardware manufacturer/designer of the Framework laptops and components.

Framework as a private company has shareholders and investors and this will undoubtedly set the company up as profit first, however the founder and CEO is one who has a vision of repairability, upgradability, customisability in mind and in turn make their products more sustainable and better for the environment. The problem is that legally the corporation is not set up like a B corporation (B stands for Benefit corporation), which have not only profit as it's fiduciary duty of the board of directors but also include making a positive impact on society. If the founder disappears for whatever reason then this corporation could turn into a classical one where profit is the only priority and then we're back to square one. There are no legal protections whatsoever to prevent a change like this. Maybe I'm wrong, but since Framework is a private company and Framework hasn't published their articles of incorporation on their website, we simply don't know how the company's legal structure is and what kind of protections are in place.

Other parties directly involved are the consumers who buy Framework laptops and components. As customers give money in exchange for products they want, the company has an incentive to listen to their customers, so in turn the happy customers do word of mouth advertising.

Parties indirectly involved

Suppliers and/or vendors who provide hardware chips and parts to Framework. Investors and/or shareholders are also indirectly involved. Framework does the designing of hardware with certain partners and uses some standard parts from creditable partners like Intel (for CPUs and wifi cards), AMD (for CPUs and GPUs) and others like Realtek (audio chips).

Previously Framework was shipping the mainboard and subassemblies from China. With the 12th Gen Intel Core version of the Framework 13 Laptop, the mainboard and major subassemblies are also made in Taiwan too. Making everything in Taiwan makes sure that Framework has better control over the production process and might even reduce the risk of supply interruptions. The manufacturing happens in Taiwan at the site in Taoyuan, Taiwan

and their partner is Compal Electronics, Inc. who has decades of experience making laptops for other companies such as Dell and Lenovo (Framework Computer, Inc., 2022).

The relationship between OEM (Original Equipment Manufacturer) and ODM (Original Design Manufacturer) is very critical for the success of the OEM. In this case Framework is the OEM and outsources some or most parts of the manufacturing to the ODM, which is Compal who has the factory plants and experience to make Framework's design a reality (SEACOMP, n.d.).

Lawmakers and regulatory entities play an indirect yet influential role in the landscape of electronic products. For instance, in the European Union, the CE marking is a certification mark that indicates conformity with health, safety, and environmental protection standards for products sold within the European Economic Area. Such regulations and standards indirectly shape the design, manufacturing, and distribution processes of electronic products, ensuring they meet specific criteria before reaching consumers (European Commission, n.d.).

5. Norms and values

In this ethical research report we will delve into the different norms and values we see here at play. Understanding the foundational norms and values of Framework and its customers is crucial in our ethical examination. These elements not only dictate the behaviour of the company and its consumers but also reflect larger societal standards.

- **Transparency:** Framework places a high premium on transparency. They are forthright about every aspect of their operations, from their manufacturing processes to the open-source nature of almost all the firmware and software used in their laptops. This commitment ensures that customers are fully informed about the origins and methods of their laptops' production.
- **Honesty**: An unwavering commitment to truth and integrity in all operations, resonating with a broader societal value of trustworthiness.
- **Responsibility:** Framework's emphasis on reducing electronic wastage aligns with broader societal expectations of resource conservation and sustainability.
- **Sustainability:** Embracing environmental stewardship and long-term planning, echoing global calls for greener business practices.
- **Fairness:** By being transparent and open about their operations, Framework aligns with societal values of equity and justice.

6. Impact (micro, meso and macro)

The introduction of Framework's easily repairable and modular laptops not only challenges the tech industry's norms but also has implications at various levels: micro (individual level), meso (community/organisational level), and macro (societal and global level). Let's delve

into the impact at each of these levels below.

Micro

- **Consumer empowerment:** Framework's focus on repairability and upgradability offers a fresh perspective to individual consumers. Rather than feeling compelled to throw away devices that aren't working perfectly, they now have the choice to repair or upgrade them. This approach not only results in cost savings but also instils a deeper sense of ownership.

  When consumers realise they can extend the life of their devices, it fosters a mindset of value and longevity.

- **Environmental Awareness:** Choosing to repair or upgrade has broader implications than just personal benefits. Every time a consumer opts for these choices, it reduces the demand for brand-new devices. This, in turn, lessens the environmental impact associated with manufacturing and disposing of tech products. Furthermore, it aids in conserving the rare minerals and limited resources that are frequently used in electronic production.

  Being a part of the Framework community amplifies this consciousness. Members become more informed about e-waste challenges and the larger effects of their buying choices on the environment.

- **Skill development:** The modular design of Framework's products encourages individuals to delve deeper into the hardware components of their devices. Traditionally, many people have been apprehensive about opening up their electronic devices due to fears of damaging them or voiding warranties. This hesitancy often prevents them from acquiring hands-on technical skills. However, Framework's approach demystifies this process, fostering a DIY culture. As individuals become more comfortable with the idea of repairing or upgrading their devices, they not only save costs but also enhance their technical skills, gaining a deeper understanding of the technology they use daily.

  This newfound confidence can be transformative. For some, what starts as a simple act of replacing a component might ignite a passion for repair work, leading them to become professional repairmen or delve into other DIY projects. It's a ripple effect; once someone discovers their capability in one area, it can spark curiosity and drive in others. Such individual transformations, when multiplied across a community, have the potential to start a larger movement towards self-reliance and sustainability.

Meso

- **Shift in business practices:** The potential for change through Framework's approach largely depends on more people having access to and choosing their products. Right now, the tech industry's move towards making devices that are sustainable and easy to repair is still in the beginning stages. Only a few companies, like Framework and Fairphone, are leading this change. Even though they're growing, they still make up a small part of the market. For a big change in the industry, these easy-to-repair devices need to be both more affordable and more widely available. Additionally, we need more companies to start making devices with these values in mind. As Framework laptops and similar products become easier to get and more affordable, and as more companies join in, more people will start choosing these products.

  This growing demand, fueled by more choices and better availability, will provide a strong incentive for the larger tech industry to change their ways. It's not just about a couple of companies doing things differently; it's about the entire market changing because of what people want and choose.

- **Community building:** The open-source approach adopted by Framework for both hardware and software components is a game-changer. It not only allows for transparency and customization but also actively encourages a community of enthusiasts, developers, and innovators to contribute and adapt the product to their unique needs. For instance, the open design of the extension ports means that anyone can create their own modules, leading to a plethora of innovative add-ons and functionalities.

  Additionally, the ease with which the motherboard (called the mainboard) can be removed from the laptop chassis offers users the flexibility to repurpose or integrate it into different setups, tailored to their specific requirements. This level of adaptability and community involvement ensures that the product is continually evolving, driven by the collective creativity and expertise of its user base.

- **Economic implications:** As more consumers adopt the mindset of repairing and upgrading, businesses related to tech maintenance and parts supply could see a surge in demand. Instead of consumers immediately opting for a new device when faced with an issue, there might be a growing trend towards seeking repairs or upgrades. This could lead to a potential boost for local repair shops and parts suppliers, while also promoting a more sustainable economic model in the tech industry.

Macro

- **Reduction in e-waste:** Modular designs, like those championed by Framework, have the potential to significantly reduce global e-waste. By making devices that can be easily repaired and upgraded, we can address one of the most pressing environmental challenges of our time. The key to this shift lies not just in companies adopting these designs, but also in the collective demand of consumers.

  As more people opt for sustainable tech choices, it sends a clear message about the kind of products they want to see in the market.

- **Policy and regulation:** The growing popularity of sustainable devices can have a ripple effect on policy decisions. Regulatory bodies and lawmakers, such as the EU Parliament and US Congress, take note of public sentiment. As consumers voice their preferences, backed by actions like protests and petitions, it can drive these institutions to implement policies that support sustainable tech practices.

  The success of companies like Framework and Fairphone can serve as a catalyst, encouraging policymakers to support movements like the 'right to repair', leading to regulations that prioritise repairability and upgradability in tech products.

- **Ethical production:** With consumers demanding transparency and sustainability, there could be a push towards more ethical production practices across the tech industry, benefiting workers and the environment. And also a significant reduction in child labour.

In conclusion, Framework's modular approach to laptops has the potential to create ripples of positive change across various levels. From empowering individual consumers to influencing global tech practices, the impact is profound and far-reaching.

7. Conclusion

The tech industry, for years, has been characterised by a relentless drive for innovation, often at the expense of sustainability and consumer empowerment. Framework Computer, Inc. emerges as a beacon of hope in this landscape, challenging the status quo with its emphasis on repairability, upgradability, and sustainability. In my opinion, Framework's approach is commendable and aligns with my personal values, as evidenced by my choice to own a Fairphone 4, another champion of modular and repairable design. I'm also in strong favour of using devices as long as possible and I strongly avoid throwing away devices which could be repaired and used for different purposes. I like tinkering with everything and tinkering will also improve one's understanding of how things work.

Supporting arguments:

- **Consumer empowerment:** Framework's design philosophy empowers consumers by offering them the choice to repair or upgrade their devices. This not only fosters a sense of ownership but also promotes a culture of value and longevity. By giving consumers the tools and knowledge to maintain their devices, Framework is fostering a shift from a throwaway culture to one of sustainability.
- **Environmental impact:** The modular design, if adopted widely, can significantly reduce global e-waste. Every time a consumer opts to repair or upgrade, it reduces the demand for new devices, leading to a decrease in the environmental footprint associated with production and disposal. This approach is not just beneficial for the environment but also ensures that fewer rare minerals and scarce raw materials are exploited.

Counter-arguments

- **Risk of bankruptcy:** One could argue that if Framework goes bankrupt, consumers might be left without options for upgrades, parts, or components for repair. However, the open-source nature of Framework's design means that even if the company were to face challenges, the community could potentially step in to provide solutions, ensuring the longevity of the products.
- **Price concerns:** Another argument is that the higher price point of Framework laptops might deter potential buyers, leading to less awareness about the benefits of repairability and upgradability. While the initial cost might be higher, the long-term savings from not having to replace the entire device and the environmental benefits make it a worthy investment. Moreover, as more consumers become aware and demand such products, economies of scale could potentially bring down prices in the future.

In conclusion, while there are valid concerns about the adoption of modular designs, the benefits, in my opinion, far outweigh the potential drawbacks. Framework's approach is not just a business model; it's a call for change in an industry that desperately needs to prioritise sustainability and consumer empowerment. As consumers, our choices can drive this change, and supporting companies like Framework is a step in the right direction.

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